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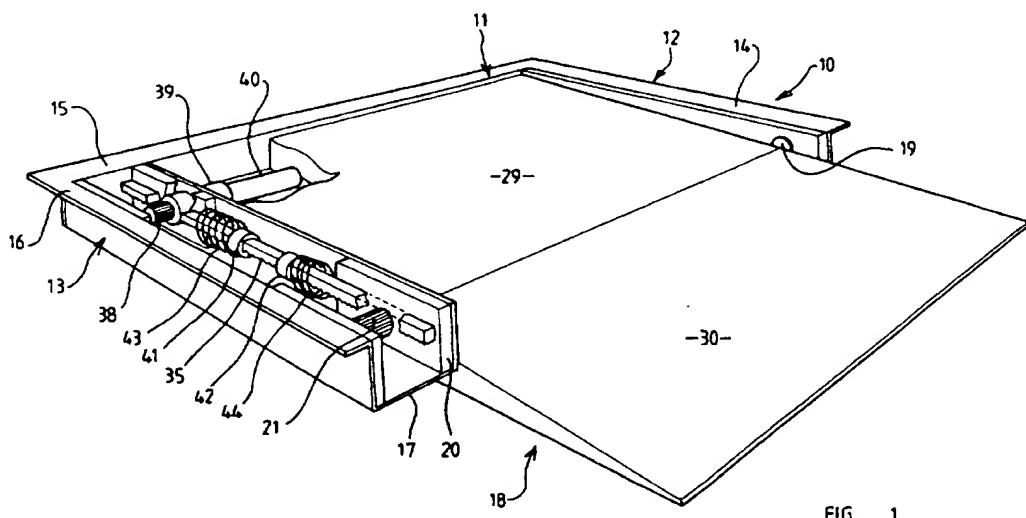
(56) Documents Cited  
GB 2274092 A GB 2116940 A GB 0585917 A  
US 4657233 A

(58) Field of Search  
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## (54) Ramp assembly

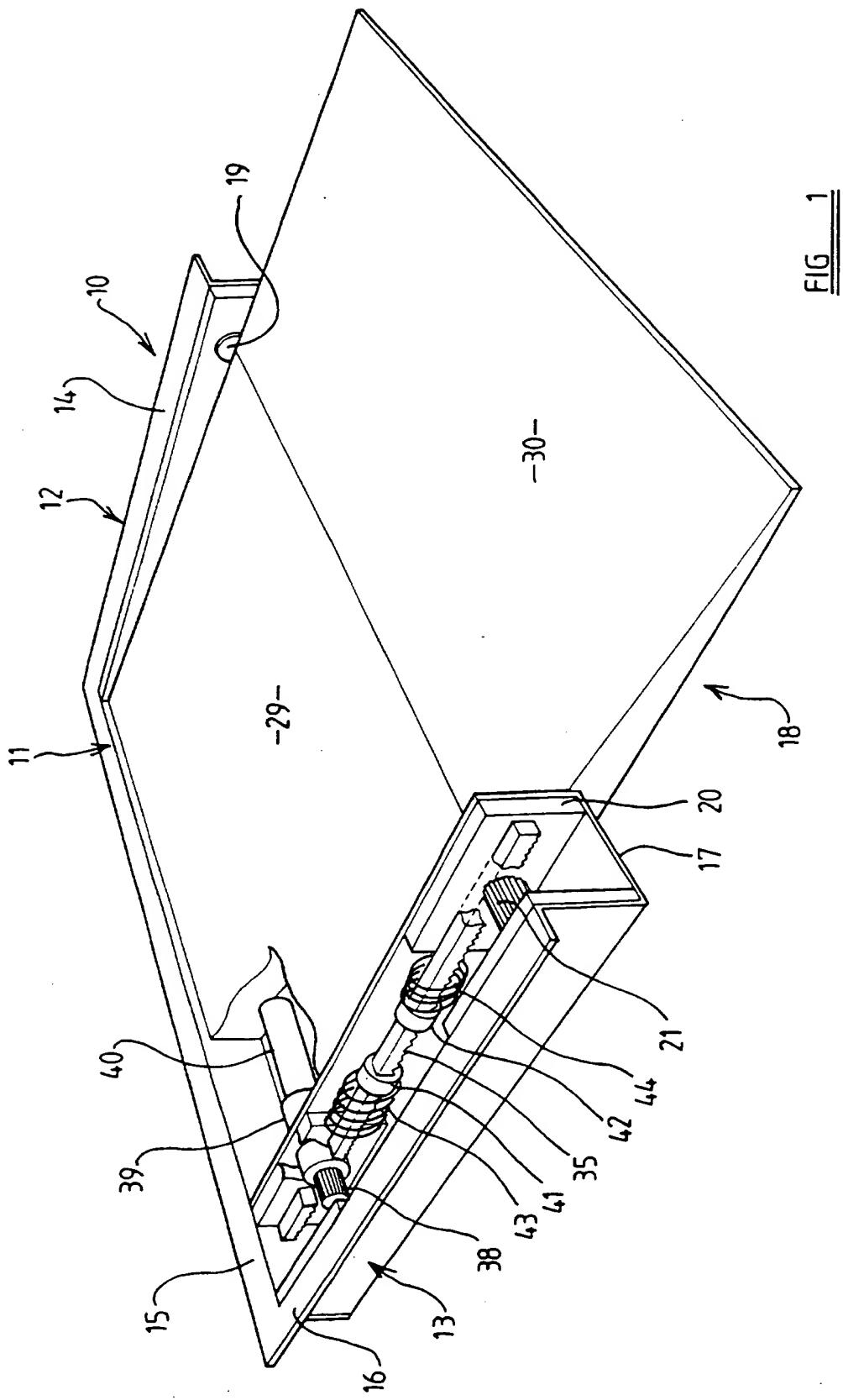
(57) A ramp assembly for facilitating wheel chair access to a vehicle comprises a frame 10 and a ramp member 18 pivotably mounted relative to the frame for movement between a first, retracted position and a second, outwardly extending position, the ramp member being pivotable about an axis (22, Figure 2b) which is spaced inwardly of an edge of the ramp member and the edge lying adjacent an edge region of the frame when the ramp member is retracted. Preferably a fixed support member of tapering thickness and having an upwardly facing surface 29 lies within the frame, the surface 30 of the ramp member, which is also tapering in thickness, lying face to face with the surface 29 when the ramp member is retracted and the two surfaces lying in a line when the ramp member extends outwardly. Preferably the ramp member is pivotably moved by a rack member 35 which engages a pinion 21, operation of an electric motor 40 causing reciprocation of the rack member 35.

Spring means 43,44 may be loaded when the ramp member is in at least one of its two positions. Operation of the motor may be determined by an electronic control unit incorporating the motor.



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This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995



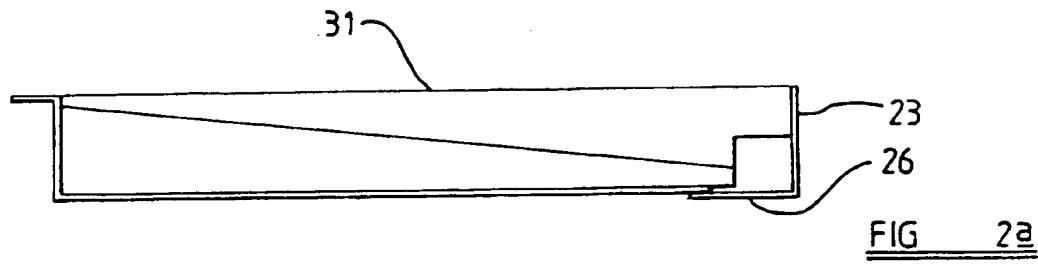


FIG 2a

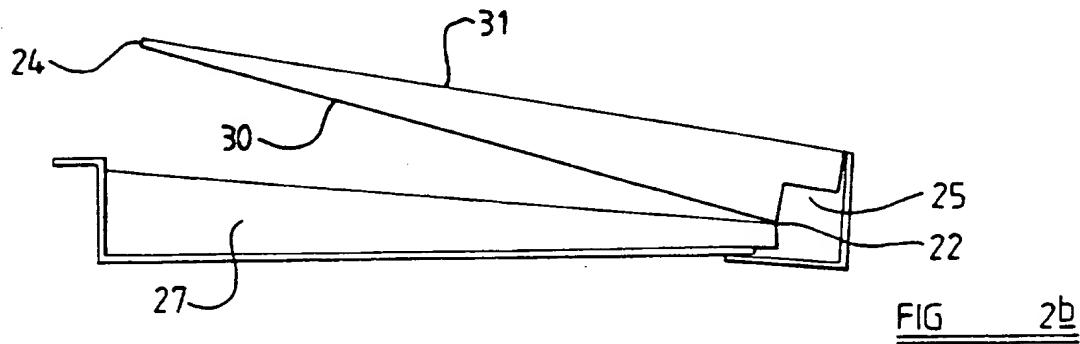


FIG 2b

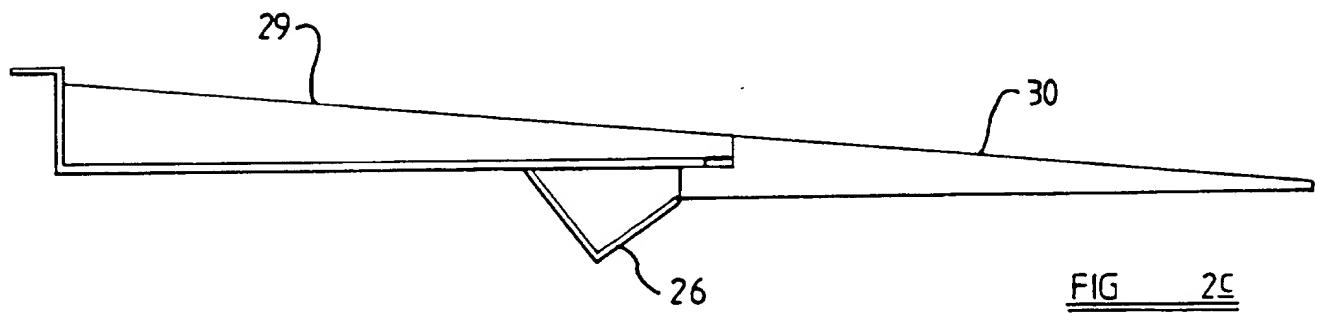


FIG 2c

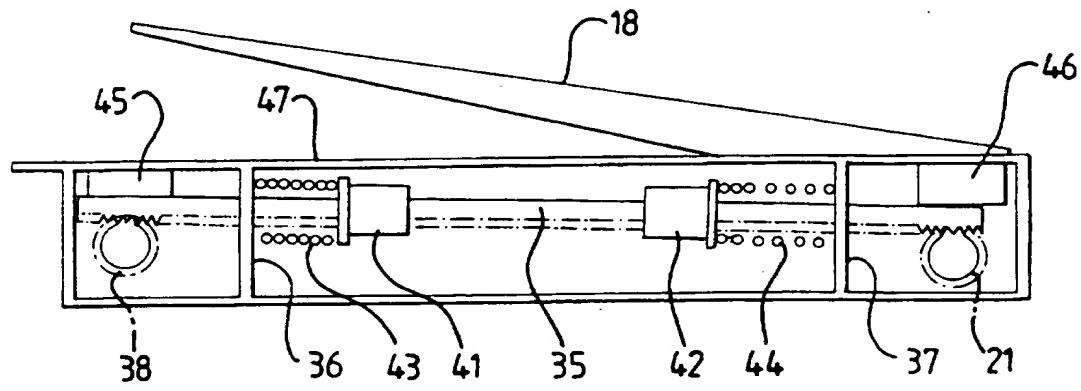


FIG 3

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PATENTS ACT 1977

GMD/A8701GB/D17

Title: **RAMP ASSEMBLY**

Description of Invention

This invention relates to ramps for facilitating wheelchair access to passenger carrying vehicles such as, for example, buses.

"Low floor" buses, wherein the interior floor of the vehicle, particularly adjacent the entrance/exit door thereof, is positioned at a lower height above ground level than has usually been the case with traditional buses, are becoming increasingly common. Further, buses are now available with so-called "kneeling suspension" wherein when the vehicle is stationary the suspension is able to be operated to lower the entrance/exit door of the vehicle to a position closer to the ground than it normally assumes when the vehicle is being driven. Either of these expedients makes it possible for a wheelchair-bound person to board or alight from the vehicle, as long as some form of ramp is provided to bridge the gap which necessarily exists between the edge of the floor at the vehicle's door and the adjacent kerb. There have been various proposals for designs of ramp which can be deployed from the vehicle for this purpose, such ramps being movable either pivotably or linearly relative to the vehicle.

It is broadly the object of the present invention to provide a vehicle access ramp which is improved in one or more respects compared with such ramps which have been proposed hitherto. Aspects of a ramp in accordance with the present invention and their advantages will be referred to hereafter.

According to one aspect of the invention, we provide a ramp assembly for facilitating access to a vehicle, comprising a frame and a ramp member pivotably mounted relative to the frame for movement between a first position wherein the ramp member is retracted and a second position in which the ramp member extends outwardly from an edge region of the frame; wherein said ramp member is pivotable about an axis which is spaced inwardly of the ramp member

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from an edge thereof, which edge of the ramp member lies adjacent said edge region of the frame when the ramp member is in its retracted position.

Preferably the pivotal mounting of the ramp member is afforded by pivot members provided on the ramp member at opposite sides thereof and engaging in bearing means carried by the frame of the ramp assembly.

One advantage of such offset disposition of the pivot axis, spaced from the edge of the ramp member, is that the need for conventional "piano hinges" or the like at the edge of the ramp member is avoided.

A further advantage resulting from such disposition of the pivot axis of the ramp member is that a part of the main weight of the ramp member is counterbalanced by the portion of the ramp member between the pivot axis and said edge thereof. Whilst the requirement for the ramp member to extend sufficiently far when in its second position to be able to reach from a vehicle to the adjacent kerbside, in most situations likely to be encountered in practice, means that only a small proportion of the weight of the ramp member can be counterbalanced, such counterbalancing nevertheless means that the force required to be exerted e.g. by a motor means, for moving the ramp member between its two positions is slightly reduced.

Preferably the ramp member, when in its first position, upwardly presents a support surface which preferably lies generally level with an uppermost boundary of the frame, and the ramp member is pivotable upwardly from such position and then downwardly until, when in its second position, a second, opposite, support surface of the ramp member is presented upwardly.

Preferably the ramp member is tapered in respect of its thickness, being of maximum thickness adjacent its pivot axis and minimum thickness at its opposite edge.

Such tapered configuration of the ramp member, such that the ramp member as a whole is somewhat wedge-shaped, enables it to be of lightweight but still to have sufficient rigidity. It also reduce imbalance of the ramp member.

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Preferably the frame of the ramp assembly carries a support member including an upwardly presented support surface which is overlaid by the ramp member when the latter is in its first position. Such support surface of the support member may be inclined downwardly towards said edge region of the frame and be generally in line with the upwardly presented second support surface of the ramp member when the ramp member is in its second position.

Together with the disposition of the pivot axis of the ramp member, as above referred to, the tapered configuration of the ramp member is geometrically advantageous in that its second support surface can be arranged to incline downwardly to meet an adjacent ground surface and yet require a range of pivotal movement of the ramp member of only 180° or slightly more, e.g. 200°.

Preferably there is provided motor means for effecting movement of the ramp member between its first and second positions, and said motor means has connection with the ramp member by way of a rack and pinion mechanism.

Conveniently said rack and pinion mechanism comprises a rack member mounted for reciprocation relative to the frame of the assembly and engaging a pinion connected to the ramp member and angularly movable therewith about the pivot axis thereof.

Preferably the ramp member is arranged to be reciprocably operated by an electric motor, by way of a reduction gearbox and an output pinion which meshes with the rack member.

There may be spring means which is arranged to be loaded when the ramp member is in at least one of its first and second positions, and to be relaxed when the ramp member is away from said at least one position. Preferably the spring means is loaded at both the first and second positions of the ramp member.

This assists in overcoming the unbalanced weight of the ramp member when the ramp member is being moved from its first and its second positions. Thus there is, again, a lesser requirement on the force required to be exerted by the motor means for moving the ramp member.



The spring means may comprise compression springs arranged to be compressed by the rack member as it approaches respective opposite limits of its reciprocatory movement.

According to another aspect of the invention, we provide a ramp assembly for facilitating access to a vehicle, comprising a frame and a ramp member pivotably mounted relative to the frame for movement between the first position wherein the ramp member is retracted and a second position in which the ramp member extends outwardly from an edge region of the frame, wherein said pivotal movement of the ramp movement relative to the frame is effected by motor means having connection with the ramp member by way of a rack and pinion mechanism.

According to another aspect of the invention, we provide a ramp assembly for facilitating access to a vehicle, comprising a frame; a ramp member pivotably mounted relative to the frame for movement between a first position wherein the ramp member is retracted and a second position in which the ramp member extends outwardly from the frame; motor means for effecting movement of the ramp member between its first and second positions, and spring means arranged to be loaded when the ramp member is in at least one of its first and second positions and to be relaxed when the ramp member is away from said at least one position.

According to another aspect of the invention, we provide a ramp assembly for facilitating access to a vehicle, comprising a frame; a ramp member pivotably mounted relative to the frame for movement between a first position wherein the ramp member is retracted and a second position in which the ramp member extends outwardly from the frame, wherein the ramp member is tapered in respect of its thickness, being of maximum thickness adjacent its pivot axis and minimum thickness at or adjacent its opposite edge.

Features referred to above as possibly being provided in a ramp assembly according to the first aspect of the invention may, independently, be

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provided in a ramp assembly in accordance with any of the further aspects of the invention.

The invention will now be described by way of example with reference to the accompanying drawings, of which:-

Figure 1 is a perspective view of a ramp assembly in accordance with the invention, with the ramp member thereof deployed;

Figure 2 (a), (b), (c) shows, diagrammatically, possible positions the ramp member of the ramp assembly is able to assume in use;

Figure 3 shows diagrammatically the condition of the operating mechanism of the ramp assembly, when the ramp is in the position shown in Figure 2(b) of the drawings.

Referring firstly to Figure 1 of the drawings, a ramp assembly comprises a frame indicated generally at 10, which in plan view is generally of U-shaped configuration comprising an end portion 11 and side portions 12, 13. The frame is adapted to be mounted in the floor structure of a passenger carrying vehicle such as, for example, a bus adjacent an entrance/exit door thereof and with the side portions 12, 13 of the frame extending generally perpendicular to the outer edge of the vehicle's floor structure and end portion 11 of the frame generally parallel thereto. The portions of the frame are metal sections, e.g. pressings or extrusions and each has at its upper edge an outwardly extending flange as indicated at 14, 15, 16 for the side portion 12, end portion 11, and side portion 13 respectively, to overlie the floor structure adjacent the frame. The frame portion 13 includes a generally U-section part 17 in which the operating mechanism to be described hereafter is disposed.

The frame 10 carries a pivotable ramp member indicated generally at 18. The ramp member 18 is pivotably secured to the frame by pivot members, not shown, which extend outwardly at opposite sides of the ramp member and engage in bearing members held by the frame portions 12, 13. Part of such a bearing member for the frame portion 12 is indicated at 19 and in relation to the frame portion 13 there is shown a member 20 of a suitable bearing material

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which supports the pivot member. Beyond the bearing member 20 and within the U-section part 17 of the frame portion 13 the pivot member connected to the ramp member is fast with a pinion 21.

As is clearly seen from Figure 2, the axis 22 about which the ramp member 18 is pivotable by virtue of the above described bearing arrangement, lies inwardly of the ramp member from the adjacent edge 23 thereof, towards the opposite edge 24 thereof. The thickness of the ramp member is a maximum adjacent its edge 23 and a minimum at its opposite edge 24, so that the ramp member as a whole is generally wedge-shaped. At the edge 23 of the ramp member, there is a rebate 25 which is covered by an L-shaped pivoted cover member 26 secured to the ramp member at its edge.

Within the frame 10 there is fixed a support member 27 which like the ramp member 18 is of wedge-shaped configuration so that an upwardly presented surface 29 thereof is inclined downwardly at a small angle from the frame portion 11 towards the pivot axis 22 of the ramp member 18. Both the ramp member 18 and support member 27 may be of a "sandwich" construction comprising relatively thin and lightweight metal skins, e.g. of aluminium alloy, and a lightweight core material, e.g. end-grain balsawood or a honeycomb material. Such construction provides rigidity and light weight.

The range of pivotal movement of the ramp member is such that it is movable between a first, retracted, position depicted in Figure 2(a), in which one surface 30 of the ramp member lies face to face with the surface 29 of the support member 27 and the opposite surface 31 of the ramp member is presented upwardly to be able to support a portion or object, and a second, deployed, position (shown in Figure 1 and Figure 2(c)) in which the surface 30 of the ramp member is generally in line with the surface 29 of the support member 27. In this condition there is virtually no gap between the surfaces 29, 30 so that a wheelchair can ascend or descend the two surfaces without difficulty. The ramp member is able to pivot to some extent beyond the position shown in Figure 2(c)

(by, for example, approximately 20° or so of pivotal movement) to allow for some variation in ground surface level which the ramp contacts when it is deployed.

For pivotally moving the ramp member, there is mounted within the portion 17 of the frame member 13 a rack member 35. The rack member 35 is supported for reciprocating movement and passes through two spaced walls 36, 37 extending transversely across the frame member 13, such walls not being visible in Figure 1. Beyond the wall 37, the rack member 35 engages the pinion 21. Beyond the wall 36, the rack member 35 engages a pinion 38 which is on the output shaft of a multi-stage epicyclic reduction gearbox 39 drivable by an electric motor 40. Support blocks 45, 46 carried by a cover 47 (not shown in Figure 1) guide the rack member 35 for its reciprocating movement and hold it in engagement with the pinions 38, 21 respectively. The rack member 35 carries two spaced collars 41, 42 and respective coil compression springs 43, 44 are disposed between such collars and the walls respectively.

Operation of the electric motor 40 in the appropriate direction causes reciprocation of the rack member 35 and thus pivotal movement of the ramp member. As the extreme positions, as depicted in Figure 2(a) and Figure 2(c), of the ramp member are approached, the appropriate one of the springs 43, 44 is compressed and it will be appreciated that the force exerted by such spring when compressed acts in opposition to the unbalanced weight of the ramp in such positions. Thus the motor need not be able to exert as much torque as would be the case if such springs were not provided. Further, it will be appreciated that since the pivot axis 22 of the ramp member is offset from its edge 23, the ramp member is to some extent counterbalanced and this again reduces the demands on the motor 40. The tapered configuration of the ramp member also reduces its imbalance about the axis 22. The portion of the ramp member immediately adjacent its edge 23 may be hollow and contain one or more inserted elements of a dense material, further to reduce imbalance of the ramp member about its axis 22.

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Because the torque required to be exerted by the motor is relatively reduced, the reduction gearbox 39 can have a reduction ratio which enables "backdriving" i.e. the motor and gearbox do not prevent the ramp from being moved manually if this should be necessary. Also, if the motor should be de-energised before the ramp member has completed its movement to its first or its second position, such movement is completed by the effect of gravity on the ramp member, in a controlled manner.

A ramp assembly in accordance with the invention is intended for operation at a doorway of a vehicle which nearly always will be adjacent to the driving position. Thus it is intended that operation of the ramp assembly should be controlled by the vehicle's driver. A control system would be provided which would preferably include an interlock arrangement with the vehicle's doors so that the ramp cannot be deployed or retracted unless the associated doors have firstly been fully opened. Conversely, the door controls would be arranged so that the door may not be closed unless the ramp member of the ramp assembly has reached its first, retracted position.

Operation of the motor of the ramp unit preferably would be determined by an electronic control unit incorporating a micro-processor. It may incorporate a means for monitoring the current consumed by the motor, and if a pre-set threshold limit of such current is exceeded this would be interpreted as the meeting of an obstruction by the ramp member. In this case the motor may be de-activated for a pre-set time interval before it is able again to be brought into operation.

Thus the invention provides a ramp assembly of compact, lightweight and rigid construction which is advantageous in many of its constructional and operational features.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any

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combination of such features, be utilised for realising the invention in diverse forms thereof.

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## CLAIMS

1. A ramp assembly for facilitating access to a vehicle, comprising a frame and a ramp member pivotably mounted relative to the frame for movement between a first position wherein the ramp member is retracted and a second position in which the ramp member extends outwardly from a edge region of the frame; wherein said ramp member is pivotable about an axis which is spaced inwardly of the ramp member from an edge thereof, which edge of the ramp member lies adjacent said edge region of the frame when the ramp member is in its retracted position.
2. A ramp assembly according to claim 1 wherein the pivotable mounting of the ramp member is afforded by pivot members provided on the ramp member at opposite sides thereof and engaging in bearing means carried by the frame of the ramp assembly.
3. A ramp assembly according to claim 1 or claim 2 wherein the ramp member, when in its first position, upwardly presents a support surface which lies generally level with an uppermost boundary of the frame, and the ramp member is pivotable upwardly from such position and then downwardly until, when in its second position, a second, opposite support surface of the ramp member is presented upwardly.
4. A ramp assembly according to any one of the preceding claims wherein the ramp member is tapered in respect of its thickness, being of maximum thickness adjacent its pivot axis and its minimum thickness at its opposite edge.
5. A ramp assembly according to any one of the preceding claims wherein the frame of the ramp assembly carries a support member affording an upwardly

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presented support surface which is overlaid by the ramp member when the latter is in its first position.

6. A ramp assembly according to claim 5 wherein said support surface of a support member is inclined downwardly towards said edge region of the frame and is generally in line with said upwardly presented second support surface of the ramp member when the ramp member is in its second position.

7. A ramp assembly according to any one of the preceding claims comprising motor means for effecting movement of the ramp member between its first and second positions, said motor means having connection with the ramp member by way of a rack and pinion mechanism.

8. A ramp assembly according to claim 7 wherein said rack and pinion mechanism comprises a rack member mounted for reciprocation relative to the frame of the assembly, said rack member engaging a pinion connected to the ramp member and angularly moveable therewith about a pivot axis thereof.

9. A ramp assembly according to claim 7 or claim 8 wherein the ramp member is arranged to be reciprocably operated by electric motor, by way of a reduction gearbox and an output pinion meshing with the rack member.

10. A ramp according to any one of the preceding claims further comprising spring means arranged to be loaded when the ramp member is in at least one of its first and second positions, and to be relaxed when the ramp member is away from said at least one position.

11. A ramp assembly according to claim 10 wherein the spring means is arranged to be loaded at both the first and second positions of the ramp member.

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12. A ramp assembly according to claim 10 or claim 11, as appendant to claim 8, wherein said spring means comprises at least one compression spring arranged to be compressed by the rack member as it approaches respective opposite limits of its reciprocatory movement.

13. A ramp assembly for facilitating access to a vehicle, comprising a frame; a ramp member pivotably mounted relative to the frame for movement between a first position wherein the ramp member is retracted and a second position in which the ramp member extends outwardly from an edge region of the frame and; a motor means for effecting said movement of the ramp member between its first and second positions, and wherein said motor means has connection with the ramp member by way of a rack and pinion mechanism.

14. A ramp assembly for facilitating access to a vehicle, comprising a frame; a ramp member pivotably mounted relative to the frame for movement between a first position wherein the ramp member is retracted and a second position in which the ramp member extends outwardly from an edge region of the frame; and further comprising spring means arranged to be loaded when the ramp member is in at least one of its first and second positions and to be relaxed when the ramp member is away from said at least one position.

15. A ramp assembly for facilitating access to a vehicle, comprising a frame; a ramp member pivotably mounted relative to the frame for movement between a first position wherein the ramp member is retracted and a second position in which the ramp member extends outwardly from the frame, wherein the ramp member is tapered in respect of its thickness, being of maximum thickness adjacent its pivot axis and minimum thickness at or adjacent its opposite edge.

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16. A ramp assembly substantially as hereinbefore described with reference to the accompanying drawing.
17. Any novel feature or novel combination of features described herein and/or in the accompanying drawing.

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**Patents Act 1977**  
**Examiner's report to the Comptroller under Section 17**  
**(The Search report)**

Application number  
**GB 9520708.0**

<b>Relevant Technical Fields</b>	Search Examiner <b>MARTIN DAVEY</b>
(i) UK Cl (Ed.O)      B8E (E23A, E23C)  (ii) Int Cl (Ed.6)      B60P	Date of completion of Search <b>29 FEBRUARY 1996</b>
<b>Databases (see below)</b> (i) UK Patent Office collections of GB, EP, WO and US patent specifications.  (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 1-12

**Categories of documents**

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2274092 A	(LONDON UNDERGROUND) see pivots G2 in Figure 2 in particular	1, 2
X	GB 2116940 A	(NEILL) see ramp pivots in Figure 4 in particular	1, 2
X	GB 585917	(CHAPLIN) see pivot 28 in Figures 3 and 4	1, 2
X	US 4657233	(VROOM)	1

Databases: The UK Patent Office database comprising standard collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

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